INFORMATION TECHNOLOGY SOPHISTICATION AMONG PUBLIC INSTITUTIONS OF HIGHER LEARNING IN MALAYSIA

(CODE S/O 777010)

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Disclaimer

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EXECUTIVE SUMMARY

This work is grounded in contemporary evidence on current status of IT sophistication in public institutes of higher learning (IPTAs). Such evidence was gathered by face-to-face interviews with the IT director of seventeen IPTAs over a three-month period. It covers all aspects of IT sophistication like computer supports, IT infostructure, IT policy, and IT strategic plans, with particular attention being given to the modes (integration, development, maintenance) of application systems and IT plans for the next five years.

The work shows that IPTAs have different levels of IT sophistication. In terms of IT support, most IPTAs do not have adequate support, i.e. IT staff and IT training. Hence many IPTAs are still struggling to develop a fully integrated "campus-wide" information system. Those with more sophisticated IT infostructure focus on the enhancement of network infrastructure.

Overall, the work suggests that IPTAs have taken necessary steps to equip their campus with necessary IT facilities. However, as highlighted in their strategic IT plans, much work still lies ahead. Smart partnerships with third parties seem to be the best solution.

1.0 INTRODUCTION

In recent years, the roles of Information technology (IT) and information system (IS) have grown in importance. Rapid changes and developments in the IT domain have created new leaders in the market place, including education. Therefore, institutes of higher learning could not run away from this fact but to take up the challenges and create opportunities to adopt IT in their activities. Many institutes of higher learning have been promoting the integration of IT into their administration and learning systems by introducing, among others, e-learning, staff and students portal. In Malaysia, despite the various programs established by the government, the extent, mode and quality of IT integration among institutes of higher learning is still an issue of great concern (Vicziany and Puteh, 2004). Hence, this study attempts to investigate the sophistication of IT adopted by institutes of higher learning in Malaysia, in the specific context of Public Institute of Higher Learning (IPTA). Findings from this study are hoped to shed the light of the current status of IT initiatives among IPTAs in Malaysia.

2.0 RESEARCH OBJECTIVES

This main objective of this study is to investigate the sophistication of IT adopted by IPTAs in Malaysia. More specifically, this study aims:

1. To investigate the computer support profile of IPTAs
2. To investigate the IT infostructure of IPTAs
3. To identify IT policy adopted by IPTAs
4. To identify IT strategic plan of IPTAs

3.0 LITERATURE REVIEW

Reviews of literature indicate that several studies have been conducted to investigate the extent, mode and quality of IT adopted by institute of higher learning. For example, Devlin and Meyerson (2001) revealed that IT is central to a number of academic endeavors at Indiana University. To achieve this, the university has implemented strategic planning for the development of IT. Their Strategic Information Systems Planning (SISP) outlines the use of IT in research and development, teaching and learning, telecommunications and administrative supports. It recognizes the transformational power of IT in higher education and the pace of technological change. Earlier, Rowley, Lujan and Dolence (1997) suggested that focused attention must be applied to stimulating innovations in pedagogy, research and management through computer usage.

In India, the tertiary sector produces nearly 122,000 skilled graduates of direct relevance of India's expanding IT software sector each year, and the achievement reflects the heavy IT investment made in universities, Institutes of Management and Indian Institutes of Technology (Vicziany and Puteh, 2004). In Thailand, 75% to 97% of their higher educational institutions implemented IT in administration and academic activities including registration, accounting, personnel and entrance systems. Ninety-seven percent of Thai institution classrooms were also equipped with IT capabilities. However, while almost all Thai institutions have attempted to update IT, they have constraints in IT manpower and finance. Therefore IT strategic plan was required for effective IT management (Titthasiri, 2000).

In Malaysia, institutes of higher learning have also been promoting the integration of IT into their administration and learning systems. In order to support the development of IT in Malaysia, Malaysian Government through Malaysian Administrative Modernization and Management Planning Unit (MAMPU) has launched the Public Sector ICT Strategic Plan (ISP) during the Public Sector CIO's Conference in August 2003. The ISP is to ensure that the planned ICT initiatives are parallel to the public sector's ICT vision, which is to provide efficient and quality services to the community at large.

Despite the various programs established by the government, the sophistication of IT integration among IPTAs is still an issue of great concern. For example, results from Vicziany and Puteh's (2004) study about ICT in Malaysian universities revealed the following: (1) Malaysian universities have not taken up ICT in innovative pedagogical way; (2) most of the universities that have encouraged ICT have done so in an ad hoc manner that does not go much beyond placing existing course materials onto university course intranets for students to consult; (3) with few exceptions, Malaysia universities do not have ICT strategies; (4) ICT approaches have not been used to develop interaction between staff and students; (5) even modest developments such as online lecture notes have been resisted by staff who see the new ICT approaches as being time consuming and difficult to manage; and (6) teacher resistance to using ICT strategies to enhance their teaching reflects the lack of administrative support and training.

More recently, Ismail, Salim and Tayib (2005) have investigated the perceptions of Malaysian accounting academicians toward the issue of IT integration in accounting education. Among the issues highlighted by the study are inadequate facilities for

students, poor network services, and lack of technical supports. Further, nearly two-thirds of the respondents are not satisfied with the amount of IT training allocated to them.

The above discussions indicate that while Malaysian institutes of higher learning, with the help of government, has take necessary steps to integrate IT into their education systems, they are still lagged behind their counterparts in developed countries like the United States. Lack of internal IT experts appears to be the main reason behind the failure of many institutes of higher learning to develop a "university-wide" system. Smart partnership between institutes of higher learning and software providers, for example, seems to be a better solution for institutes of higher learning to become e-university.

4.0 METHOD

In Malaysia, there are eleven universities and six university colleges that can be classified as Public Institutes of Higher Learning (IPTA). All seventeen IPTAs were used in the survey. To achieve the purpose of this study, a semi-structured questionnaire was first developed. The questionnaire was pre-tested with several experienced accounting and IT staff, including the Director of Computer Center, Universiti Utara Malaysia. The final set of questionnaire consists of 37 items which was divided into several sections, i.e. demographic information of the institutions, IT infostructure, IT policy, and IT strategic plan. The mail questionnaires were addressed to the Director of Computer Center of each institution, and followed by face-to-face interviews. Using the dual methods, this study managed to get feedbacks from all respondents, giving a 100% response rate. However, some of the respondents are quite reluctant to disclose some of the information which they classified as confidential.

5.0 RESULTS

This section is divided into two sub-sections, i.e. demographic information and IT sophistication. Demographic section discusses general information of all institutions participated in this study, whilst IT sophistication section discusses IT-related information of each institution.

5.1 Demographic

Table 1 show that eleven universities and six university colleges participated in this study. Nearly half of the institutions were established more than 20 years ago, which can be considered as matured IPTAs. Twenty nine percent of the institutions were established in 5 years or less time, mostly the university colleges.

Table 1: Category

Category	Frequency	Percent
University	11	64.7
University College	6	35.3
Total	17	100.0

Table 2: Number of Years Established

Years Established	Frequency	Percent
5 years or less	5	29.4
Between 6 and 10 years	2	11.8
Between 11 and 15 years	2	11.8
More than 20 years	8	47.1
Total	17	100.0

Table 3 shows the minimum, maximum, and means of faculties, departments, institutes/centers, student colleges, academic staff, administrative staff, and students. Table 3 shows that number of academic staff range from 147 to 5626, and number of students range from 1907 to 24697.

Table 3: Number of Faculties, Departments, Centers, Colleges, Academic Staff, Administrative Staff, and Students

Items	N	Min	Max	Mean
Faculties	16	3	24	10.38
Departments	13	4	107	15.77
Centers	14	1	22	9.21
Colleges	16	0	16	8.81
Academic Staff	15	173	1812	869.33
Administrative Staff	14	147	5626	1406.50
Students	14	1907	24697	10831.79

5.2 IT Sophistication

This section discusses the institution profile, computer support profile, IT infostructure, IT policy, and IT strategic plan of each institution. Institution profile consists of information such as number of faculties, departments, institutes/centers, student colleges, academic and administrative staff, and students. Computer support profile reveals information like number of IT staff, adequacy of IT training and source of IT training. IT infostructure specifically look into the types of application systems, operating systems, and network services of the institutions. IT policy divulges information such as budget allocation for IT development, acquisition and upgrade of hardware and software, and disposal of IT assets. The section ends with important information relating to institutions strategic IT plans.

Universiti A

The profile of Universiti A is presented in Table 4a.

Table 4a: University Profile

Category:	University
Year Established:	Confidential
Location:	Confidential
Number of branch:	Confidential
Number of faculty:	13
Number of department:	10
Number of center/institute:	14
Number of student college:	16
Number of academic staff:	1105
Number of administrative staff:	1106 (excluding contract staff)
Number of students:	Confidential

Computer Support

Universiti A computer center is responsible for all IT-related services. It has a total of 130 IT staff of various positions. In order to offer effective and efficient services to its community, computer center assigned each responsibility center with a system analyst or a programmer, where as lab assistant is assigned to each computer lab. The director of computer center claimed that ~~Universiti A~~this university provides adequate IT training not only to its IT staff but also to non-IT staff. The sources of basic IT training such as Microsoft Office applications for non-IT staffs are conducted by computer centre, whilst a more advance training are jointly conducted with third parties. Table 4b provides a summary of computer support profile.

Table 4b: Computer Support Profile

Number of system analysts:	30
Number of programmers:	43
Number of technicians/operators:	55
Number of lab assistants:	2
Other:	0
Adequacy of IT staff:	Yes
Adequacy of IT training (IT):	Yes
Knowledge/skill required (if NO):	Not Applicable
Adequacy of IT training (non-IT):	Yes
Source of IT training (non-IT):	Mixed of Internal and External

IT Infostructure

Universiti A has several application systems to serve its academic and administrative purposes. Computer center has full responsibility for the development and maintenance of all application systems in this university. Except for Learning and Library, all other applications are developed and maintained internally. It is claimed that all applications are fully integrated and are also Web-enabled. Table 4c and 4d present a summary of application, operating and network systems in Universiti A.

Table 4c: Application systems

System	Integration	Development	Maintenance
Personnel	Fully	In-house	Internal
Finance	Fully	In-house	Internal
Student Affairs	Fully	In-house	Internal
Teaching	Fully	External	Joint
Research & Development	Fully	In-house	Internal
Registration	Fully	In-house	Internal
Exam Scheduling	Fully	In-house	Internal
Library	Fully	External	External

Universiti A has a total of 6000 data points. Currently, it network services use a combination of leased and satellite lines. The director claimed that all campus community has access to the Internet as shown in Table 4d.

Table 4d: Operating system and network:

Operating system:	Windows, UNIX and Linux
Number of data point:	6000
Network service:	Leased line and satellite line
Cabling system:	Structured cabling, single and multimode, and unshielded twisted pair
Internet access (academic staff):	All
Internet access (admin staff):	All
Internet access (student):	All

IT Policy

Universiti A allocated about RM5million (including staffs salary) to computer center per annum. Whilst each responsibility center has its own IT budget, the acquisition of specific hardware and software must be made via computer center. Currently, the university policy relating to PC ownership is 1 to 1 for administrative staff and 1 to 10 for students. Surprisingly, PC is not allocated to academic staff. Therefore, computer center is not responsible for the maintenance of the academic computers.

Table 4e: IT Policy

IT Budget overall (%/amount):	5 million
IT Budget responsibility center (%/amount):	Every faculty has their own budget which includes IT
PC ratio (academic staff):	No allocation
PC Ratio (admin staff):	1-1
PC Ratio (student-technical):	1-10
PC Ratio (student-non technical):	1-10
Acquisition (hardware):	Centralized
Acquisition (software):	Centralized
Upgrade (hardware):	Centralized
Upgrade (software):	Centralized
Disposal:	After 5 years

IT Strategic Plan

Universiti A strategic IT plan for the next five years is more on development of infrastructure such as wireless coverage, upgrade network capabilities and setting disaster

recovery plan. The director of computer center believed that at the moment the university has enough capacity to facilitate its students and staffs need. Therefore, it is about time for the university to provide the platform for campus community to easily access to the systems. In summary, Universiti A IT strategic plans are as follows:

1. Upgrade network infrastructure
2. Enhance wireless coverage
3. Setup disaster recovery plan

Universiti B

The profile of Universiti B is presented in Table 5a.

Table 5a: University Profile

Category:	University
Year Established:	Confidential
Location:	Confidential
Number of branch:	Confidential
Number of faculty:	16
Number of department:	6
Number of centers/institute:	9
Number of student college:	14
Number of employee (academic):	1,812
Number of employee (administrative):	2,435
Number of student:	20,044

Computer Support

Universiti B IT center has a total of 47 IT staff. This number is obviously not adequate to provide efficient and effective services to almost 25,000 staff and students combined. As a result, IT staff will only be assigned to other responsibility centers upon request. As a normal practice, two IT staff will be assigned to the non-technical departments, whilst a maximum of three IT staff will be assigned to the technical departments.

Table 5b: Computer Support

Number of system analyst:	16
Number of programmer:	21
Number of technician/operator:	10
Number of lab assistant:	0
Other:	7
IT staff assign to responsibility center:	Yes
Staff assigned:	System analyst and programmer
Adequacy of IT staff:	No
Adequacy of IT training (IT):	No
Knowledge/skill required (if NO):	Project management
Adequacy of IT training (non-IT):	Yes (continuous training)
Source of IT training (non-IT):	Internal

While IT division conducted IT training continuously to its staff, the director noted that the staffs need more training to keep update with the latest technology gadgets, especially relating to the knowledge and skills of project management.

IT Infostructure

Universiti B has several application systems under its roof as shown in Table 5c. Among them is Sistem Pengurusan Office Automation (SPOA), which is built using Lotus Notes. This system is partly integrated and captures all personnel information, including bulletin, staff attendance and leave application, inventory management, and vehicle information system. SPOA is developed and maintained jointly with external parties.

Table 5c: Application System

System	Integration	Development	Maintenance
Personnel	Partly	Joint	Joint
Finance	Partly	External	External
Student Affairs	Partly	In-house	Internal
Teaching	No	In-house	Internal
Research & Development	Partly	External	External
Registration	Partly	In-house	Internal
Exam Scheduling	Partly	In-house	Internal
Library	No	External	External

Finance system is developed and maintain externally. Universiti B uses Standard Accounting for Government Agencies (SAGA) system for its finance system, and the system is partly integrated with other systems. Student-related application systems such as Student Affairs, Registration and Exam Scheduling are also partly integrated, and developed and maintained internally. IT division has recently introduced Student Portal which is integrated with the Finance and Student Affairs systems. Teaching application, on the other hand, is developed and maintained internally by faculties, with the support

from IT Division. However, this application is a stand-alone system. Table 5d presents a summary of operating and network systems in Universiti B. Currently, this university has a total of 14,000 data points and is going for wireless in the future to serve its Internet community.

Table 5d: Operating system and network

Operating system:	Windows, UNIX, Linux and Macintosh
Number of data point:	14000
Network service:	Leased line
Cabling system:	Structured cabling system, singlemode, multimode and unshielded twisted pair
Internet access (academic staff):	All
Internet access (admin staff):	All
Internet access (student):	All

IT Policy

Annually, about 5% of the total budget will be allocated for IT development. Universiti B adopted a centralized policy relating to the acquisition of hardware and software for campus usage. Hardware will be upgraded based on request and disposal of IT assets are normally done between three to five years.

Table 5e: IT Policy

IT Budget overall (%/amount):	5%
IT Budget responsibility center (%/amount):	-
PC ratio (academic staff):	1-1
PC Ratio (admin staff):	1-1
PC Ratio (student-technical):	1-4
PC Ratio (student-non technical):	1-6
Acquisition (hardware):	Centralized
Acquisition (software):	Centralized/Decentralized
Upgrade (hardware):	Centralized
Upgrade (software):	Centralized
Disposal:	Between 3 to 5 years

IT Strategic Plan

Universiti B has set up the following IT plan for the next five years:

1. Wireless campus
2. Develop a Portal system that integrates students, staffs and community
3. Develop security system (CCTV) around campus
4. Integrate all application systems in university
5. Develop digital library and document management systems

Universiti C

The profile of Universiti C is presented in Table 6a.

Table 3-1: University Profile

Category:	University
Year Established:	Confidential
Location:	Confidential
Number of branch:	Confidential
Number of faculty:	14
Number of department:	107
Number of centers/institute:	3
Number of student college:	13
Number of employee (academic):	1,811
Number of employee (administrative):	2,785
Number of student:	24,697

Computer Support

Centre for Information Technology has 70 IT staff and 11 administrative staff to serve almost 30,000 of its staffs and students combined. Whilst the director noted that this centre does not have enough staff due to several reasons, he believed that Universiti C still can provide adequate IT training to its IT and non-IT staff. More advance IT trainings, however, are jointly conducted with external parties.

Table 6b: Computer Support Profile

Number of system analyst:	34
Number of programmer:	29
Number of technician/operator:	7
Number of lab assistant:	0
Other:	11
IT staff assign to responsibility center:	Yes (but to only 2 departments)
Staff assigned:	System analyst
Adequacy of IT staff:	No
Adequacy of IT training (IT):	Yes
Knowledge/skill required (if NO):	Not Applicable
Adequacy of IT training (non-IT):	Yes
Source of IT training (non-IT):	Mixed of Internal and External

IT Infostructure

Administrative applications in Universiti C use a client-server based system but do not support Web-based services. These include Financial Information System (FIS), Human Resource Information System (HRIS), Facility Management System (FMS), Sistem Kewangan, and Course and Teaching Evaluation. All of these administrative applications are claimed to be fully integrated. Application systems related to Personnel and Teaching are jointly developed and maintained with external parties. Meanwhile application systems for Student Affairs, Registration and Exam Scheduling, and Research and Development are developed and maintained internally. Finance system, however, has been developed internally and maintained jointly with external parties. Table 6c and 6d present a summary of application, operating and network systems in Universiti C.

Table 6c: Application systems

System	Integration	Development	Maintenance
Personnel	Fully	Joint	Joint
Finance	Fully	In-house	Joint
Student Affairs	Fully	In-house	Internal
Teaching	Fully	Joint	Joint
Research & Development	Fully	In-house	Internal
Registration	Fully	In-house	Internal
Exam Scheduling	Fully	In-house	Internal
Library	-	-	-

Universiti C has a total of 8,000 data points and uses leased line for its network services. The director of IT, however, claimed that the number is enough to serve almost 30,000 of its Internet community.

Table 6d: Operating system and network

Operating system:	Windows and Linux
Number of data point:	8,000
Network service:	Leased Line
Cabling system:	Structured cabling system, Single and Multimode fiber optic, and Unshielded Twisted Pair
Internet access (academic staff):	All
Internet access (admin staff):	All
Internet access (student):	All

IT Policy

For year 2005, Universiti C allocates 4.6% of total budget for IT development and infrastructure. The computer centre is responsible for the acquisition and upgrading of hardware and software for campus use, including for academic and administrative staff. However, responsibility centers are allowed to purchase hardware in small quantities and to purchase specialized software that will be used at the respective centers. In this case, the upgrading of the hardware and software will be done by the responsibility center itself. Finally, disposal of old IT facilities will be done by Asset Management Department, which follows the JPA procedure.

Table 6e: IT Policy

IT Budget overall (%/amount):	4.6%
IT Budget responsibility center (%/amount):	-
PC ratio (academic staff):	1-1
PC Ratio (admin staff):	1-1
PC Ratio (student-technical):	1-8 (excluding special usage, i.e. post graduates and research students)
PC Ratio (student-non technical):	
Acquisition (hardware):	Centralized
Acquisition (software):	Centralized
Upgrade (hardware):	Centralized
Upgrade (software):	Centralized
Disposal:	After five years

IT Strategic Plan

The director, unfortunately, cannot disclose Universiti C IT strategic plan for the next five years due to the university policy.

Universiti D

The profile of Universiti D is presented in Table 7a.

Table 7a: University Profile

Category:	University
Year Established:	Confidential
Location:	Confidential
Number of branch:	Confidential
Number of faculty:	-
Number of department:	-
Number of centers/institute:	-
Number of student college:	9
Number of employee (academic):	-
Number of employee (administrative):	-
Number of student:	16865

Computer Support

The Head of Computer Department was reluctant to disclose the number of IT staff under its roof. However, he claimed that the existing number of staffs is not adequate, and similar goes to the IT training. Despite this, he still has to assign his staff, normally programmer and system analyst, to other responsibility centers. There are two situations with which the IT staff is assigned to other responsibility centers. The first is called a "pull" concept, where IT staff will be attached to the respective responsibility center for a number of periods but still reported to the computer centre. The second alternative is the IT staff will be attached and also reported to the respective responsibility center. For example, five IT staffs are assigned and thus reported to the Universiti D branch.

Since the department does not has enough IT staff, the head of the department felt that it could not afford to organize an advance IT training to the staff. Among the most needed training is Mobile Application which is a new application in Malaysia. Apart from this, the computer center does provide training on basic applications through the

Training Bureau which is conducted more in terms of peer-to-peer basis. “Peer-to-peer” means that there will be a few people who will undergo the training. After completed the training, they will give the same training to their colleagues and so on.

Table 7b: Computer Support Profile

Number of system analyst:	-
Number of programmer:	-
Number of technician/operator:	-
Number of lab assistant:	-
Other:	-
IT staff assign to responsibility center:	Yes
Staff assigned:	System analyst/programmer
Adequacy of IT staff:	No
Adequacy of IT training (IT):	No
Knowledge/skill required (if NO):	CTI and Mobile application
Adequacy of IT training (non-IT):	Yes
Source of IT training (non-IT):	Internal

IT Infostructure

Universiti D has several application systems to serve its campus community. The developments of these application systems are outsourced but maintained internally. Most of the application systems are only partly integrated with other systems. Several compelling reasons are given by the respondents to justify why the systems have not been fully integrated:

1. Re-engineering an old university will create many problems with the staff and management.
2. It is difficult to redo the infrastructure where a top up would be needed here and there.
3. Majority of the staff are in the middle and upper age where it is hard for this group to change their working environment and learn new IT gadgets.

Therefore, whilst acknowledging the importance of integrated system, the respondent felt that it is hard to change from the existing (isolated) systems to a fully integrated system.

Table 7c: Application system

System	Integration	Development	Maintenance
Personnel	Partly	External	Internal
Finance	Partly	External	Internal
Student Affairs	Partly	External	Internal
Teaching	Partly	External	Internal
Research & Development	Partly	External	Internal
Registration	Combined with student affairs system		
Exam Scheduling			
Library	Partly	Joint	Internal

In terms of operating system, Universiti D uses Windows, UNIX (for server) and Linux. The 8Mb Leased line, Satellite line and Wireless are used to connect users to the Internet. Whilst the respondent was reluctant to disclose the number of data points, he believed that the existing data points are sufficient to meet current needs.

Table 7d: Operating system and network

Operating system:	Windows, UNIX and Linux
Number of data point:	Confidential
Network service:	Leased line, Satellite Line, Wireless
Cabling system:	Structured cabling system and unshielded twisted pair
Internet access (academic staff):	All
Internet access (admin staff):	All
Internet access (student):	All

IT Policy

Adhering to the university policy, the respondent did not disclose the amount of annual budget allocated to IT development. However, looking at the PC ratio for staffs and students, it is believed that Universiti D has allocated a large amount of money on PC investment compared to other universities. Quite differently, Universiti D has also adopted a decentralization policy relating to the acquisition and upgrade policy of hardware and software.

Table 7e: IT Policy

IT Budget overall (%/amount):	Confidential
IT Budget responsibility center (%/amount):	Confidential
PC ratio (academic staff):	1-1
PC Ratio (admin staff):	1-1
PC Ratio (student-technical):	1-1
PC Ratio (student-non technical):	1-2
Acquisition (hardware):	Decentralized (based on requirements)
Acquisition (software):	Decentralized (based on requirements)
Upgrade (hardware):	Decentralized (based on requirements)
Upgrade (software):	Decentralized (based on requirements)
Disposal:	Determined by Majlis Pelupusan Universiti

IT Strategic Plan

Similar to Universiti C, Universiti D IT strategic plan for the next five years cannot be disclosed due to university policy.

Universiti E

The profile of Universiti E presented in Table 8a.

Table 8a: University Profile

Category:	University
Year Established:	Confidential
Location:	Confidential
Number of branch:	Confidential
Number of faculty:	10
Number of department:	7
Number of centers/institute:	22
Number of student college:	11
Number of employee (academic):	1731
Number of employee (administrative):	2444
Number of student (full time):	17,806

Computer Support

As at June 2005, the computer centre has 105 IT staff. With the large number of staff, the director believed that Universiti E has sufficient IT staff to provide efficient and effective IT-related services to the campus community. Similar to the practice of other universities, this centre E has also assigned IT staff to other responsibility centers, but on two basis, permanent basis (assigned to the Treasury Department) and six months basis.

While the director seems to be satisfied with the number of its staff, he did not think that the IT staffs received adequate training. He proposed a continuous training for all IT staffs to keep update with the latest technology gadgets. He, however, believed that IT training for non-IT staff, conducted in collaboration with Human Resource Department and external parties, are adequate. In order to further improve the quality of its services, this centre has implemented Zoning System to:

1. Plan overall ICT needs for faculties/departments

2. Identify and overcome problems related to the implementation of ICT services
3. Ensure policies endorsed by the University is implemented completely by faculties/departments
4. Collect and analyze data and information related to ICT

This centre has divided Universiti E campus into six zones as follows: Zone A, B, C, D, E and F. Each zone will be assigned a system analyst and a programmer.

Table 8b: Computer Support Profile

Number of system analyst:	69 (combined)
Number of programmer:	
Number of technician/operator:	36
Number of lab assistant:	0
Other:	28
IT staff assign to responsibility center:	Yes
Staff assigned:	system analyst/programmer (permanent or 6 months basis)
Adequacy of IT staff:	Yes
Adequacy of IT training (IT):	No
Knowledge/skill required (if NO):	Continuous IT training to Staff
Adequacy of IT training (non-IT):	Yes
Source of IT training (non-IT):	Mixed of Internal and External

IT Infostructure

Universiti E has developed several application systems for its campus use. Most of the application systems are developed and maintained internally. The main weakness of the systems, for example, Personnel and Finance, is that they are developed as a stand alone and cannot be integrated with other application systems. The director, however, claimed that it is now in the process of integrating these two systems. At the moment, this centre has successfully integrated the Student Affairs application system with Registration and Exam Scheduling systems. Other application systems developed and maintained by this

centre are Aduan On-line, e-Borang and Sistem Pengurusan Projek. Table 8c and 8d present a summary of application, operating and network systems in Universiti E.

Table 8c: Application system

System	Integration	Development	Maintenance
Personnel	No	In-house	Internal
Finance	No	In-house	Internal
Student Affairs	Partly	In-house	Internal
Teaching		In-house	Internal
Research & Development	External		
Registration	Combined with students affairs system		
Exam Scheduling			
Library	External		

The director was reluctant to disclose the number of data points in Universiti E. However, he claimed that the existing number of data points is adequate to serve nearly 22,000 of its Internet community.

Table 8d: Operating system and network

Operating system:	Windows, UNIX and Linux
Number of data point:	-
Network service:	Leased Line to Internet (ISP) 34 Mgb through JARING
Cabling system:	Multimode Fiber Optic (going to Singlemode)
Internet access (academic staff):	All
Internet access (admin staff):	All
Internet access (student):	All

IT Policy

For year 2005, RM9 million of its total annual budget was allocated to IT department. The amount consists of RM7 million for the management and operation of IT services, and RM2 million for staff salary. The IT centre is solely responsible for the acquisition and upgrade of hardware and software for the university. Centralized hardware purchasing will be done every five years (if needed). This centre, however, is only responsible for the purchasing of standard software for campus usage. Specialized software for faculty usage will be managed by faculty with its own IT budget. This is because faculties have their own budget for their specific IT needs. Disposal of old IT facilities is normally done after 5 years.

Table 8e: IT Policy

IT Budget overall (%/amount):	RM 7 million for management/operation, and RM2 million for staff salary
IT Budget responsibility center (%/amount):	Every faculty has their own budget
PC ratio (academic staff):	1:1
PC Ratio (admin staff):	1:1
PC Ratio (student-technical):	1:1
PC Ratio (student-non technical):	1:5
Acquisition (hardware):	Centralized (every five year)
Acquisition (software):	Centralized
Upgrade (hardware):	Centralized
Upgrade (software):	Centralized
Disposal:	After 5 years

IT Strategic Plan

Universiti E IT strategic plan for the next five years also cannot be disclosed due to the university policy.

Universiti F

The profile of Universiti F is presented in Table 9a.

Table 9a: University Profile

Category:	University
Year Established:	Confidential
Location:	Confidential
Number of branch:	Confidential
Number of faculty:	12
Number of department:	16
Number of centers/institute:	5
Number of student college:	5
Number of employee (academic):	494
Number of employee (administrative):	470
Number of student:	10806

Computer Support

Universiti F obviously does not have adequate IT staff to provide efficient and effective IT-related services to its campus community, consisting of 10,000 students and 900 staffs. Table 9b shows that, at the moment, the computer center has only 20 staffs including 8 administrative staff.

Table 9b: Computer Support Profile

Number of system analyst:	6
Number of programmer:	2
Number of technician/operator:	2
Number of lab assistant:	2
Other:	8
IT staff assign to responsibility center:	Yes
Staff assigned:	System analyst/programmer
Adequacy of IT staff:	No
Adequacy of IT training (IT):	No
Knowledge/skill required (if NO):	Network and specific training for programmers
Adequacy of IT training (non-IT):	Yes
Source of IT training (non-IT):	Internal

Despite this limitation, the director of computer center claimed that 2 system analysts and 3 programmers are assigned to other responsibility centers and faculties. He also claimed that Universiti F does not provide adequate training for IT staff, in particular network and programming languages. Apart from it, the director believed that computer center has provided adequate IT training for non-IT staff.

IT Infostructure

Universiti F has developed several application systems for the use of its campus community. Most of the application systems are developed using external expertise due to shortage of internal experts. However, most of the application systems are only partly integrated. Application systems like Student Affair, Registration, Exam Scheduling and Hostel Management are integrated with each other. Others application systems like Personnel and Teaching systems are not integrated at all. Recently, computer center has take initiative to develop internally a stand alone Teaching system for several faculties. Table 9c presents a summary of application systems in Universiti F.

Table 9c: Application system

System	Integration	Development	Maintenance
Personnel	No	External	External
Finance	Partly	External	External
Student Affairs	Partly	External	External
Teaching	No	In-house	Internal
Research & Development	None	None	None
Registration	Combined with students affairs system		
Exam Scheduling			
Library	Partly	External	External

The director of IT center noted that the existing data point is enough to serve its Internet community. Table 9d summarizes the operating and network systems in Universiti F.

Table 9d: Operating system and network

Operating system:	Windows, UNIX and Linux
Number of data point:	6000
Network service:	Leased line
Cabling system:	Structured cabling system, singlemode and multimode fiber optic and unshielded twisted pair
Internet access (academic staff):	All
Internet access (admin staff):	All
Internet access (student):	All

IT Policy

The Director of computer center claimed that about 20 percent of total budget for 2005 was allocated for IT development. The entire IT budget for whole university is controlled by the IT centre, in which all acquisition and upgrade of hardware and software must go through the center which will bring the matter to the technical advisor. Currently, the university policy relating to PC ratio is 1 to 4 for academic staff, which will gradually be reduced to 1 to 1. For administrative staff the ratio is 1 to 1. PC ratios for medical, technical and non technical students are currently 1 to 1, 1 to 3 and 1 to 10 respectively.

Table 9e: IT Policy

IT Budget overall (%/amount):	20%
IT Budget responsibility center:	-
PC ratio (academic staff):	1-4 (going to 1-1)
PC Ratio (admin staff):	1-1
PC Ratio (student-technical):	1-3 (except medical students 1-1)
PC Ratio (student-non technical):	1-10
Acquisition (hardware):	Centralized
Acquisition (software):	Centralized
Upgrade (hardware):	Centralized
Upgrade (software):	Centralized
Disposal:	After 5 years

IT Strategic Plan

Universiti F strategic IT plans for the next five years are to have a fully integrated and Web-based system throughout the university. The university also aims toward open source systems in the future. Computer centre also hopes that it can provide up to 50 percent of the systems maintenance. Lastly, Universiti F attempts to provide wireless Internet broadband services to every college in campus. In summary, Universiti F IT strategic plan for the next five years are as follows:

1. Develop a fully integrated system
2. Develop a Web based system
3. Open sources
4. Outsource up to 50 percent of PC maintenance
5. Hotspot for every college

Universiti G

The profile of Universiti G is presented in Table 10a.

Table 10a: University Profile

Category:	University
Year Established:	Confidential
Location:	Confidential
Number of branch:	Confidential
Number of faculty:	14
Number of department:	-
Number of centers/institute:	12
Number of student college:	13
Number of employee (academic):	1,414
Number of employee (administrative):	1,399
Number of student:	14,588

Computer Support

Universiti G has only 34 IT staff to serve more than 15,000 of its campus community. Hence, none of the IT staff is assigned to other responsibility centers. The director of the computer center, however, claimed that Universiti G has provided enough training for IT staffs. Even though it has limited number of staff, the computer center, along with external parties, have provided continuous IT training to non-IT staff.

Table 10b: Computer Support Profile

Number of system analyst:	12
Number of programmer:	10
Number of technician/operator:	12
Number of lab assistant:	0
Other:	19
IT staff assign to responsibility center:	No
Staff assigned:	Not Applicable
Adequacy of IT staff:	No
Adequacy of IT training (IT):	Yes
Knowledge/skill required (if NO):	Not Applicable
Adequacy of IT training (non-IT):	Yes
Source of IT training (non-IT):	Mixed of Internal and External

IT Infostructure

The main system that supports university operations is Office Automation System (OA). OA is a Web-based system that use Oracle database. The system covers Personnel and Students Affair systems. Whilst OA system is developed and maintained internally by computer center, other application systems such as Finance is developed fully by external parties but jointly maintained by the center. The director of computer center claimed that most of the application systems in Universiti G are fully integrated with each others. Table 10c presents a summary of application systems in Universiti G.

Table 10c: Application system

System	Integration	Development	Maintenance
Personnel	Partly	Joint	Joint
Finance	Fully	External	Joint
Student Affairs	Fully	In-house	Internal
Teaching	Partly	External	External
Research & Development	None	None	None
Registration	Fully	In-house	Internal
Exam Scheduling	Fully	In-house	Internal
Library	Partly	External	External

The director of IT center claimed that Universiti G has a total of 25,000 data points. However, only 5,000 of the data points are active. Table 10d summarizes the operating and network systems in Universiti G.

Table 10d: Operating system and network

Operating system:	Windows, UNIX and Linux
Number of data point:	5,000 (Active); 25,000 (Overall)
Network service:	Leased Line
Cabling system:	Microwave
	Single mode fiber optic
Internet access (academic staff):	All
Internet access (admin staff):	All
Internet access (student):	All

IT Policy

Each year a sum of IT budget will be allocated to computer center which is responsible for the acquisition of hardware and software for the university. However, faculties are also allocated some portion of the IT budget for maintenance and upgrading of the hardware and software. The faculties are also allowed to buy their own specialized software. Currently, the university policy relating to the PC ratio is 1 to 1 for academic and administrative staff and 1 to 7 for students.

Table 10e: IT Policy

IT Budget overall (%/amount):	Confidential
IT Budget responsibility center (%/amount):	Centralized budget, faculty operating budget focus on maintenance and upgrading
PC ratio (academic staff):	1-1
PC Ratio (admin staff):	1-1
PC Ratio (student-technical):	-
PC Ratio (student-non technical):	1-7
Acquisition (hardware):	Centralized
Acquisition (software):	Centralized/Decentralized
Upgrade (hardware):	Faculty operating budget
Upgrade (software):	Faculty operating budget
Disposal:	After 5 years

IT Strategic Plan

Universiti G strategic plan for the next five years is to implement an e-university, which means all operations in Universiti G will be made on-line. The e-university application will fully integrate all application systems. To achieve this, the director of computer center hoped that the management will fully equipped the university with a world class IT infrastructure.

In summary, the plans are as follows:

1. To implement E-university

2. Develop super highway infrastructure and application systems
3. IT and Multimedia in classes
4. Smart & Intelligent campus (Physical Management System, Utilities Management System and Security)
5. Digital Resource Center
6. Smart (Smart Wallet, Identification and Security)

Universiti H

The profile of Universiti H is presented in Table 11a.

Table 11a: University Profile

Category:	University
Year Established:	Confidential
Location:	Confidential
Number of branch:	Confidential
Number of faculty:	11
Number of department:	4
Number of centers/institute:	11
Number of student college:	13
Number of employee (academic):	1779
Number of employee (administrative):	5626
Number of student:	17268

Computer Support

Computer center in Universiti H is quite a large department with 110 staffs including 36 administrative staffs as shown in Table 11b.

Table 11b: Computer Support Profile

Number of system analyst:	29
Number of programmer:	25
Number of technician/operator:	20
Number of lab assistant:	0
Other:	36
IT staff assign to responsibility center:	No
Staff assigned:	Not Applicable
Adequacy of IT staff:	No
Adequacy of IT training (IT):	Yes
Knowledge/skill required (if NO):	Not Applicable
Adequacy of IT training (non-IT):	Yes
Source of IT training (non-IT):	Mixed of Internal and External

The center is responsible for all IT-related services including the acquisition and upgrade of hardware and software. Despite its large number of staff, the center does not assigned IT staff to other responsibility centers. The director of the center claimed that the

department has provided adequate IT training not only for their IT staff but also to non-IT staff. The sources of IT training for non-IT staffs are jointly organized with third parties.

IT Infostructure

Apart from the Library system, all application systems under its roof are developed and maintained internally. The director of computer center claimed that system development is not a problem as it has many internal expertise especially system analysts and programmers. Furthermore, almost all application systems are fully integrated, with one main database to handle all transactions processing.

In the future, the director hopes to integrate all application systems including Teaching and Learning system. Currently Teaching and Learning system was developed based on faculty requirements on a stand-alone basis. Table 11c and 11d present a summary of application, operating and network systems in Universiti H.

Table 11c: Application system

System	Integration	Development	Maintenance
Personnel	Fully	In-house	Internal
Finance	Fully	In-house	Internal
Student Affairs	Fully	In-house	Internal
Teaching	Partly	In-house	Internal
Research & Development	Fully	In-house	Internal
Registration	Fully	In-house	Internal
Exam Scheduling	Fully	In-house	Internal
Library	Partly	External	External

Table 11d: Operating system and network

Operating system:	Windows, UNIX, Linux and Solaris
Number of data point:	8500
Network service:	Leased line
Cabling system:	Singlemode fiber optic
Internet access (academic staff):	All
Internet access (admin staff):	All
Internet access (student):	All

IT Policy

Overall IT budget allocated to computer center is RM6 million per annum and on top of that around RM200, 000 is allocated to each faculty. Despite this, the acquisition and upgrade of hardware and software must be made through computer center. In some cases, faculties are allowed to buy specialized software based on their specific needs. The disposal policy is same as other universities which followed the procedure outlined by JPA. Currently, the university policy regarding the PC ratio is 1 to 1 for academic and 1 to 1.3 for administrative staff. PC ratio for student is categorized into technical and non technical students, in which the ratios are 1 to 4 and 1 to 8 respectively.

Table 11e: IT Policy

IT Budget overall (%/amount):	RM6 million
IT Budget responsibility center (%/amount):	RM200,000 (each faculty)
PC ratio (academic staff):	1-1
PC Ratio (admin staff):	1-1.3
PC Ratio (student-technical):	1-4
PC Ratio (student-non technical):	1-8
Acquisition (hardware):	Centralized
Acquisition (software):	Centralized (standard software)
Upgrade (hardware):	Centralized
Upgrade (software):	Centralized
Disposal:	After 5 years or unworkable stage

IT Strategic Plan

Universiti H strategic plans for next five years are to have a fully integrated e-learning system and focus will be given to the content development of e-learning. To achieve the world class university status, computer center wants to have high Internet bandwidth in campus to provide easy access to the Internet and Intranet to the campus community.

1. Fully develop the content of E-learning
2. High bandwidth in campus
3. Intranet anyway and anytime

Universiti I

The profile of Universiti I is presented in Table 12a.

Table 12a: University Profile

Category:	University
Year Established:	Confidential
Location:	Confidential
Number of branch:	Confidential
Number of faculty:	24
Number of department:	7
Number of centers/institute:	19
Number of student college:	-
Number of employee (academic):	-
Number of employee (administrative):	-
Number of student:	14,000

Computer Support

Currently, Universiti I has about 20 IT staff, which is not enough to provide services to its 14,000 students.

Table 12b: Computer Support Profile

Number of system analyst:	-
Number of programmer:	-
Number of technician/operator:	-
Number of lab assistant:	-
Other:	-
IT staff assign to responsibility center:	Yes
Staff assigned:	Upon request
Adequacy of IT staff:	No
Adequacy of IT training (IT):	Yes
Knowledge/skill required (if NO):	Not Applicable
Adequacy of IT training (non-IT):	Yes
Source of IT training (non-IT):	Mixed of Internal and External

In terms of IT training, the center does provide the training to IT and non-IT staff, which will be organized at its training center.The center will prepare yearly calendar training and circulate to other responsibility centers to plan for their staff training. Basic training such as Microsoft Office applications and SPSS will be given to academic staffs, whilst

Lotus Notes, Web Design, and PC Maintenance for IT staff. Advance training for IT staff is given by third parties such as vendors. The director of the center felt that more training is needed for IT staff.

IT Infostructure

Universiti I administrative system which includes personnel, finance and student affairs has been jointly developed with third parties but maintained by the IT staff. These application systems are partly integrated which means that only certain application systems are integrated with other applications. For example, financial system is integrated with personnel system and student affairs system, whilst personnel is only integrated with financial system. Other application system like academic system is outsourced but maintained in-house. It is an off the shelf package that is customized to meet university's requirements.

According to the director of IT, he would not integrate all the application systems by using just one database. This is because he felt that he should respect the owner of the system. Contradictorily, computer center is developing a new system called the Service Agent, which will act as a centralized service to manage the Personnel, Students, Library and Finance systems. Using Service Agent, users can share only the basic data whereas the advance data will have different databases. Table 12c and 12d present a summary of application, operating and network systems in Universiti I.

Table 12c: Application system

System	Integration	Development	Maintenance
Personnel	Partly	Joint	Internal
Finance	Partly	Joint	Joint
Student Affairs	Partly	Joint	Internal
Teaching	Partly	External	Internal
Research & Development	Partly	External	20% outsource (aft. warranty)
Registration	-	-	-
Exam Scheduling	-	-	-
Library	Partly	Joint	Internal

To manage these applications, Universiti I uses Windows, UNIX and Linux as the platform. When asked about the data point, the respondent could not give an exact figure. They used leased line with multimode fiber optic cable, and wireless to connect them to the Internet.

Table 12d: Operating system and network

Operating system:	Windows, UNIX and Linux
Number of data point:	-
Network service:	Leased line and Wireless
Cabling system:	Multimode fiber optic
Internet access (academic staff):	All
Internet access (admin staff):	All
Internet access (student):	All

IT Policy

According to the director of computer center, the total annual IT budget allocated to the center is very subjective. He claimed that at the beginning of the year, the management will allocate a certain amount of money for IT, but then after a month or two, the allocated budget will be cut off. Indeed, the amount is never consistent and unreliable.

Similar to other universities, Universiti I centralized all acquisition and upgrade of hardware and software. IT assets are normally disposed off after three years but it is still subjected to the decisions made by Majlis Pelupusan Universiti. Policy for the PC ratio is

currently 1 to 1 for academic and management staff and 1 to 5 for supporting staff. PC ratio for students at the moment is 1 to 5 for technical students and 1 to 10 for non-technical students. All staff and students should have the access to the Internet including student's hostel.

Table 12e: IT Policy

IT Budget overall (%/amount):	Subjective
IT Budget responsibility center (%/amount):	Subjective
PC ratio (academic staff):	1-1
PC Ratio (admin staff):	1-5
PC Ratio (student-technical):	1-1
PC Ratio (student-non technical):	1-10
Acquisition (hardware):	Centralized
Acquisition (software):	Centralized
Upgrade (hardware):	Centralized
Upgrade (software):	Centralized
Disposal:	After 3 years

IT Strategic Plan

The director of computer center has outlined the following IT plans for the next five years:

1. PC ratio for students will be reduced to 1 to 5.
2. Set up Disaster Recovery Center
3. Integrate all application systems by setting up the Service Agent
4. Upgrade the administrative system with the latest technology
5. Upgrade the network speed between main campus and its branches.
6. Set up the Centralized Help Desk
7. Develop Centralized Document System.

Universiti J

The profile of Universiti J is presented in Table 13a.

Table 13a: University Profile

Category:	University
Year Established:	Confidential
Location:	Confidential
Number of branch:	Confidential
Number of faculty:	8
Number of department:	7
Number of centers/institute:	9
Number of student college:	12
Number of employee (academic):	464
Number of employee (administrative):	489
Number of student:	-

Computer Support

Universiti J only has 27 IT staff to serve its campus community. Hence, none of the IT staff is assigned to other responsibility centers. The director of the computer center, however, claimed that the university provides enough training to its IT staffs. Despite its limited number of IT staff, the computer center, along with external parties, provides continuous IT training to non-IT staff.

Table 13b: Computer Support Profile

Number of system analyst:	12
Number of programmer:	11
Number of technician/operator:	4
Number of lab assistant:	0
Other:	1
IT staff assign to responsibility center:	No
Staff assigned:	Not Applicable
Adequacy of IT staff:	No
Adequacy of IT training (IT):	Yes
Knowledge/skill required (if NO):	Not Applicable
Adequacy of IT training (non-IT):	Yes
Source of IT training (non-IT):	Mixed of Internal and External

IT Infostructure

University J has almost all necessary application systems under its roof such as Personnel, Finance, Students Affairs, Teaching, and Research and Development. Due to its lack of experience IT staff, these applications are developed using external expertise though maintained internally. The director of IT claimed that all application systems are fully integrated. Table 13c summarizes application systems currently being used in University J.

Table 13c: Application system

System	Integration	Development	Maintenance
Personnel	Fully	External	Internal
Finance	Fully	External	Internal
Student Affairs	Fully	External	Internal
Teaching	Fully	External	Internal
Research & Development	Fully	External	Internal
Registration	Fully	External	Internal
Exam Scheduling	Fully	External	Internal
Library	Fully	External	External

The operating systems used by this university are Windows, UNIX, Linux, and Macintosh. With the data point around 2,500 units, leased line as the network service, a combination of structured, single and multimode fiber optic and UTP cabling system, all the staff and students are connected to the Internet.

Table 13d: Operating system and network

Operating system:	Windows, UNIX, Linux and Macintosh
Number of data point:	2500
Network service:	Leased Line
Cabling system:	Structured cabling system, single and multimode fiber optic, and unshielded twisted pair
Internet access (academic staff):	All
Internet access (admin staff):	All
Internet access (student):	All

IT Policy

The director of IT was reluctant to disclose the amount of money allocated for IT development each year. He, however, noted that all acquisition, upgrade and disposal of hardware and software are centralized and subject to the approval of Jawatankuasa Teknikal Pusat ICT. Currently, the university policy relating to the PC ratio is 1 to 1 for academic and administrative staff and 1 to 5 for students.

Table 13e: IT Policy

IT Budget overall (%/amount):	Confidential
IT Budget responsibility center (%/amount):	Confidential
PC ratio (academic staff):	1-1
PC Ratio (admin staff):	1-1
PC Ratio (student-technical):	1-5
PC Ratio (student-non technical):	-
Acquisition (hardware):	Centralized (Jawatankuasa Teknikal Pusat ICT)
Acquisition (software):	Centralized (Jawatankuasa Teknikal Pusat ICT)
Upgrade (hardware):	Centralized (Jawatankuasa Teknikal Pusat ICT)
Upgrade (software):	Centralized (Jawatankuasa Teknikal Pusat ICT)
Disposal:	Centralized (Jawatankuasa Teknikal Pusat ICT)

IT Strategic Plan

According to the director of IT, the university strategic IT planning for the next five years are as follows:

1. Development and enhancement of Integrated Management System
2. Upgrading network infrastructure and Internet connections
3. Centralized backup and Data Continuity Center
4. ICT Training and consultation
5. Procurement of PC, notebooks and servers

Universiti K

The profile of Universiti K is presented in Table 14a.

Table 14a: University Profile

Category:	University
Year Established:	Confidential
Location:	Confidential
Number of branch:	Confidential
Number of faculty:	8
Number of department:	
Number of centers/institute:	
Number of student college:	6
Number of employee (academic):	544
Number of employee (administrative):	765
Number of student:	6191

Computer Support

University K is a relatively new university which will only move to its main campus by the end of this year. As a new university, the director of computer center claimed that it has insufficient IT experts. However, the center still needs to assign its staff to other responsibility centers to help them with their daily operations.

Table 14b: Computer Support Profile

Number of system analyst:	17
Number of programmer:	12
Number of technician/operator:	7
Number of lab assistant:	1
Other:	-
IT staff assign to responsibility center:	Yes & No
Staff assigned:	Programmer, Technician
Adequacy of IT staff:	No
Adequacy of IT training (IT):	No
Knowledge/skill required (if NO):	JAVA, Open Source, and Knowledge Management
Adequacy of IT training (non-IT):	Yes
Source of IT training (non-IT):	In-house

He also noted that this university does not provide sufficient budget to train IT staff, especially in the areas of programming languages (more specifically JAVA), open source systems and knowledge management. Despite this limitation, the center has to conducts training for non IT-staff on general application software and simple system maintenance.

IT Infostructure

Universiti K has several application systems under its roof. Some of the applications like Personnel (HRMS), Finance (IFAS) and E-learning are bought off the shelf but then customized to meet the users need. Other application systems like Student Information system and Students Registration system are developed in house. Though these two applications are integrated, it is not Web-enabled. Furthermore, most of the application systems are not integrated with each others, which have created many problems for management to make decisions. Currently, computer center is developing a new system using internal expertise for Research and Development. It is also in the process of jointly developing an application for exam scheduling. Table 14c below presents a summary of application systems in this university.

Table 14c: Application system

System	Integration	Development	Maintenance
Personnel	Partly integrated	Customized package	Mixed
Finance	Partly integrated	Customized package	Mixed
Student Affairs	Partly integrated	In-house	In-house
Teaching	Not Integrated	Mixed	In-house
Research & Development	Not Integrated	In-house	In-house
Registration	Not Integrated	In-house	In-house
Exam Scheduling	Not Integrated	External	In-house
Library	Not Integrated		

Table 14d presents a summary of operating and network systems in Universiti K.

Table 14d: Operating system and network

Operating system:	Windows, Unix, Linux
Number of data point:	9525
Network service:	Leased line, Wireless
Cabling system:	Structured, Single mode Fibre Optic, Multi mode Fibre Optic
Internet access (academic staff):	All
Internet access (admin staff):	All
Internet access (student):	All

IT Policy

Each year more than RM5 millions is allocated to the computer center to manage the acquisition of hardware and software for the university. The university has technical committee which will decide the acquisition of the hardware and software. Basically, faculties or centers will make their request on software acquisition early of the year and present it to the committee. Currently, the university policy regarding the PC ratio is 1 to 1 for academic and administrative staff and 1 to 4 for students.

Table 14e: IT Policy

Budget overall (%/amount):	Less than RM5 mil
Budget responsibility center (%/amount):	None
PC ratio (academic staff):	1:1
PC Ratio (admin staff):	1:1
PC Ratio (student-technical):	1:1
PC Ratio (student-non technical):	1:2
Acquisition (hardware):	Centralized
Acquisition (software):	Centralized Once a year
Upgrade (hardware):	Centralized (upon request)
Upgrade (software):	Centralized (upon request)
Disposal:	When obsolete

IT Strategic Plan

Universiti K strategic plan for next five years is to make sure that all application systems are fully integrated. Since Computer Center is short of internal expertise, it wishes to have a joint venture with vendors to help resolve integration problems. It is hoped that this will be the platform for Universiti K to get a technology transfer. Other priority for computer center is knowledge management.

Kolej Universiti L

The profile of Kolej Universiti L is presented in Table 15a.

Table 15a: University Profile

Category:	College University
Year Established:	Confidential
Location:	Confidential
Number of branch:	Confidential
Number of faculty:	7
Number of department:	12
Number of centers/institute:	4
Number of student college:	15
Number of employee (academic):	350
Number of employee (administrative):	-
Number of student:	3500

Computer Support

Kolej Universiti L computer center has 24 IT staff. Hence, according to the director of the center, it cannot afford to assign its staff to other responsibility centers on a permanent basis. If any, the staff that would be assigned is system analyst or programmer. The director also felt that its current number of staffs is not enough to provide efficient and effective services to around 3500 students and 350 staffs. Surprisingly, the director felt that its IT staff has received adequate training. In addition, the center also organizes IT training for non-IT staff which includes administrative courses such as filing. These trainings are jointly organized with third parties.

Table 15b: Computer Support Profile

Number of system analyst:	15
Number of programmer:	9
Number of technician/operator:	0
Number of lab assistant:	0
Other:	1
IT staff assign to responsibility center:	Yes
Staff assigned:	System analyst
Adequacy of IT staff:	No
Adequacy of IT training (IT):	Yes
Knowledge/skill required (if NO):	Not Applicable
Adequacy of IT training (non-IT):	Yes
Source of IT training (non-IT):	Mixed of Internal and External

IT Infostructure

Despite its limited IT staff, surprisingly, Kolej Universiti L managed to develop and maintain several application systems under its roof internally. It uses an integrated system called IMS (Integrated Management System). The system includes all academic and management application systems. Table 15c and 15d summarize all application, operating and network systems in this university.

Table 15c: Application system

System	Integration	Development	Maintenance
Personnel	Fully	In-house	Internal
Finance	Fully	In-house	Internal
Student Affairs	Fully	In-house	Internal
Teaching	Fully	In-house	Internal
Research & Development	Fully	In-house	Internal
Registration	Fully	In-house	Internal
Exam Scheduling	Fully	In-house	Internal
Library	Fully	In-house	Internal

The operating systems used are Windows, UNIX and Linux. With the data point around 3000 units, leased line and wireless as the network service, and single mode fiber optic for cabling system, all staff and students are connected to the Internet.

Table 15d: Operating system and network

Operating system:	Windows, UNIX and Linux
Number of data point:	3000
Network service:	Leased line and Wireless
Cabling system:	Singlemode fiber optic
Internet access (academic staff):	All
Internet access (admin staff):	All
Internet access (student):	All

IT Policy

The budget allocated to the Computer Centre annually is around 10 to 15 percent of the total budget. However, there is no allocation made to other responsibility centers. Currently, there are two methods that have been practiced for the acquisition of hardware and software. First, hardware and software will be bought by computer center which is normally done three times a year. The faculty or other responsibility center will first need to prepare the specification of the hardware. This specification need to be approved by technical group at the respective responsibility center and then send to the treasury to process the application. Another method is where the responsibility centre bought the hardware using its own budget. The upgrading of hardware and software is based on the needs of each responsibility centre. The rule of thumb is, if the cost to upgrade or repair is 1/3 of the cost of purchased hardware, then the hardware will be disposed off. The procedure to dispose the hardware is based on the JPA procedure.

To ensure that all staff and students can get a benefit from the IT, the university has set up a policy that the ratio for computer to all staff and students are 1 to 1 and all students have the wireless facilities at their colleges.

Table 15e: IT Policy

IT Budget overall (%/amount):	15%
IT Budget responsibility center (%/amount):	-
PC ratio (academic staff):	1-1
PC Ratio (admin staff):	1-1
PC Ratio (student-technical):	1-1
PC Ratio (student-non technical):	Not Applicable
Acquisition (hardware):	Centralized
Acquisition (software):	Centralized
Upgrade (hardware):	Centralized
Upgrade (software):	Centralized requirements
Disposal:	If repair cost is 1/3 of assets cost

IT Strategic Plan

Asked about their IT strategic plans, these are the answers:

1. To upgrade the network infrastructure so that it can become more reliable.
2. To update the IT devices such as PC and router for their permanent campus in the year 2008.

Kolej Universiti M

The profile of Kolej Universiti M is presented in Table 16a.

Table 16a: University Profile

Category:	University College
Year Established:	Confidential
Location:	Confidential
Number of branch:	Confidential
Number of faculty:	6
Number of department:	7
Number of centers/institute:	15
Number of student college:	3
Number of employee (academic):	621
Number of employee (administrative):	707
Number of student:	6,000

Computer Support

The IT center has a total of 59 IT staff, which according to the director of the center is not enough to provide efficient and effective IT services to the campus community. He also noted that the shortage of manpower is due to the coming retirement as well as volunteered retirement among the staff. As a result, no IT staff has been assigned to any responsibility center. Any inquiry and problem will go directly through IT Center.

In terms of IT training to IT staff, the director of the center claimed that only few of their staff has knowledge and skills using Linux, Windows and development tools. Hence, further IT training is required to enhance their knowledge and skills especially in the areas of system analysis and design, and strategic planning. He, however, claimed that IT training for non-IT staff is currently adequate. Basic IT training such as Microsoft Office for non-IT staff is conducted annually or based on request.

Table 16b: Computer Support Profile

Number of system analyst:	15
Number of programmer:	17
Number of technician/operator:	27
Number of lab assistant:	-
Other:	5
IT staff assign to responsibility center:	No
Staff assigned:	Not Applicable
Adequacy of IT staff:	No
Adequacy of IT training (IT):	No
Knowledge/skill required (if NO):	System analysis and design, and Strategic Planning
Adequacy of IT training (non-IT):	Yes
Source of IT training (non-IT):	Mixed of Internal and External

IT Infostructure

IT Center has developed several application systems to serve its campus community, among others, Personnel (staff information system) and Student Affairs (student information system). These application systems are claimed to be fully integrated, developed and maintained internally. For the Finance system, it is in the process to use Standard Accounting for Government Agencies (SAGA). Other applications such as Asset Management System, Library and Clinic are purchased and maintained by vendors. Surprisingly, it is still using a manual system to generate exam schedule. Table 16c presents a summary of application systems in Kolej Universiti M.

Table 16c: Application system

System	Integration	Development	Maintenance
Personnel	Fully	In-house	Internal
Finance	in process to use SAGA		
Student Affairs	Fully	In-house	Internal
Teaching	External		
Research & Development	None	None	None
Registration	On-line	In-house	Internal
Exam Scheduling	Manual		
Library	-	Joint	Joint

Table 16d presents a summary of operating and network systems in Kolej Universiti M. The operating systems used by Kolej Universiti M are Windows, UNIX and Linux. With the data point around 3000 units, leased line as the network service, all staffs and students are connected to the Internet.

Table 16d: Operating system and network

Operating system:	Windows, UNIX and Linux
Number of data point:	3,000 (approximate)
Network service:	Leased line
Cabling system:	Structured cabling system, singlemode fiber optic, multimode fiber optic, and unshielded twisted pair
Internet access (academic staff):	All
Internet access (admin staff):	All
Internet access (student):	All

IT Policy

Due to the university policy, the director of IT Center cannot disclose the amount of annual IT budget. He, however, explained that all acquisition and upgrade of hardware and software will be made by IT Center. At the moment, the acquisition process is done on a continuous basis because every year new faculties are established. The disposal policy is now set for every four years.

Table 16e: IT Policy

IT Budget overall (%/amount):	Confidential
IT Budget responsibility center (%/amount):	Confidential
PC ratio (academic staff):	1-1
PC Ratio (admin staff):	1-1
PC Ratio (student-technical):	1-1
PC Ratio (student-non technical):	1-1
Acquisition (hardware):	Centralized
Acquisition (software):	Centralized
Upgrade (hardware):	Centralized
Upgrade (software):	Centralized
Disposal:	After 4 years

IT Strategic Plan

Kolej Universiti M IT strategic plans for the next five years cannot be disclosed due to university policy.

Kolej Universiti N

The profile of Kolej Universiti N is presented in Table 17a.

Table 17a: University Profile

Category:	University College
Year Established:	Confidential
Location:	Confidential
Number of branch:	Confidential
Number of faculty:	8
Number of department:	5
Number of centers/institute:	1
Number of student college:	6
Number of employee (academic):	182
Number of employee (administrative):	147
Number of student:	1907

Computer Support

Kolej Universiti N computer center has only 20 IT staff but the director of IT claimed that the existing number of IT staff is enough to provide efficient and effective IT services to the campus community. The director, however, admitted that being a new university, Kolej Universiti N is still lack of experience IT staff and thus would like to have more training in the areas such as database administration, networking, and advance programming. According to the director of computer center, he has also assigned system analysts to other responsibility centers with the hope that they would gained more experience in developing systems, starting from writing an algorithm up to systems implementation. Despite this limitation, the IT center still provides and offers basic IT training to non-IT staff and also surrounding community.

Table 17b: Computer Support Profile

Number of system analyst:	12
Number of programmer:	3
Number of technician/operator:	4
Number of lab assistant:	0
Other:	1
IT staff assign to responsibility center:	Yes
Staff assigned:	System analyst
Adequacy of IT staff:	No
Adequacy of IT training (IT):	No
Knowledge/skill required (if NO):	Database administration, Networking, and Advance programming
Adequacy of IT training (non-IT):	Yes
Source of IT training (non-IT):	Mixed of Internal and External

IT Infostructure

Despite its limited IT staff, Kolej Universiti N has quite an advanced application systems to serve its campus community. The reason behind it is the high level of commitment and participation of top management in its IT development. Kolej Universiti N has implemented a fully integrated system which integrates all application systems in Kolej Universiti N. The system will be monitored by the director of computer center and can be accessed by the Rector. The staff and students can have access only to the applications that are related to them. The IT director claimed that this system has greatly assisted top management in making critical university decisions.

Table 17c: Application system

System	Integration	Development	Maintenance
Personnel	Fully	External	Joint
Finance	Fully	External	Joint
Student Affairs	Fully	External	Joint
Teaching	Fully	External	Joint
Research & Development	Fully	External	Joint
Registration	Fully	External	Joint
Exam Scheduling	Fully	External	Joint
Library	Fully	External	Joint

In order to connect the hardware and the application systems, Windows and Linux are used as the platform. With the total number of 1500 unit data point, it is sufficient to serve its campus Internet community. Table 17d presents a summary of operating and network systems in Kolej Universiti N.

Table 17d: Operating system and network

Operating system:	Windows
Number of data point:	1500 (approximate)
Network service:	Leased Line (4MB)
Cabling system:	Singlemode Fibre Optic
Internet access (academic staff):	All
Internet access (admin staff):	All
Internet access (student):	All

IT Policy

Kolej Universiti N allocates about 18% of its total budget to the IT center for IT development, which will then allocates about 0.4% of the 18% to each faculty. Therefore, faculties are given the authority to purchase hardware and specialized software, normally in a small amount, using their allocated budget. For campus use, the acquisition will be made by IT center. The disposal of IT assets will be determined by Majlis Pelupusan Universiti. The PC ratio is 1 to 1 for all staff and 1 to 2 for students, and it is assumed that all staff and students can easily have access to the Internet either at Kolej Universiti N campus or students' hostel.

Table 17e: IT Policy

IT Budget overall (%/amount):	5%
IT Budget responsibility center (%/amount):	
PC ratio (academic staff):	1-1
PC Ratio (admin staff):	1-1
PC Ratio (student-technical):	1-2
PC Ratio (student-non technical):	Not applicable
Acquisition (hardware):	Decentralized
Acquisition (software):	Decentralized
Upgrade (hardware):	Decentralized
Upgrade (software):	Decentralized
Disposal:	Determined by Majlis Pelupusan Universiti

IT Strategic Plan

For the next five years, Kolej Universiti N aims to:

1. To strengthen the campus networking
2. To set up new technologies such as smart card and laser technology
3. To further strengthen its application systems.

Kolej Universiti O

The profile of Kolej Universiti O is presented in Table 18a.

Table 18a: University Profile

Category:	University College
Year Established:	Confidential
Location:	Confidential
Number of branch:	Confidential
Number of faculty:	7
Number of department:	6
Number of centers/institute:	1
Number of student college:	4
Number of employee (academic):	173
Number of employee (administrative):	246
Number of student:	2200

Computer Support

Kolej Universiti O has quite a limited number and experience IT staff. To make matters worst, some of the staff especially programmers and technicians need to be assigned to other responsibility centers. Furthermore, the director of IT felt that Kolej Universiti O does not provide adequate IT training for IT staff especially in the much needed areas like networking, multimedia, e-learning and office automation systems. Despite this limitation, the center has to conduct training for non IT-staff.

Table 18b: Computer Support Profile

Number of system analyst:	6
Number of programmer:	7
Number of technician/operator:	6
Number of lab assistant:	0
Other:	0
IT staff assign to responsibility center:	Yes
Staff assigned:	Programmer and technician
Adequacy of IT staff:	No
Adequacy of IT training (IT):	No
Knowledge/skill required (if NO):	Network, Multimedia, E-learning, and Office automation
Adequacy of IT training (non-IT):	No
Source of IT training (non-IT):	Mixed of Internal and External

IT Infostructure

In line with advancement of ICT, Kolej Universiti O focuses on the development and usage of ICT among its community (i.e. administration, academic staff and students) as its main strength in its education system. To support the mission, Kolej Universiti O has developed Student Information System, Personnel Management System and Finance System that are fully integrated with each others. However, Kolej Universiti O had to outsource the development and maintenance of all application systems due to the lack of experience IT staff. Other application systems bought by Kolej Universiti O are software for English subject, library. Table 18c and 18d present a summary of application, operating and network systems in Kolej Universiti O.

Table 18c: Application system

System	Integration	Development	Maintenance
Personnel	Fully	Joint	Joint
Finance	Fully	Joint	Joint
Student Affairs	Fully	Joint	
Teaching	None	None	None
Research & Development	None	None	None
Registration	Fully	In-house	Internal
Exam Scheduling	Fully	In-house	Internal
Library	No	External	External

Table 18d: Operating system and network

Operating system:	Windows, UNIX and Linux
Number of data point:	2000
Network service:	Leased line and satellite line
Cabling system:	Structured cabling system, singlemode and multimode fiber optic and unshielded twisted pair
Internet access (academic staff):	All
Internet access (admin staff):	All
Internet access (student):	All

IT Policy

Kolej Universiti O had allocated quite a small amount of money, around 1 to 2 percent, of its annual budget to the computer center for IT infrastructure. However, this budget allocation will be increased to 5 percent by next year. Since the IT budget is fully controlled by computer centre, the acquisition and upgrade of hardware and software must be made via this centre. Currently, the university policy regarding the PC ratio is 1 to 1 for academic and administrative staff and 1 to 7 for students.

Table 18e: IT Policy

IT Budget overall (%/amount):	2%
IT Budget responsibility center (%/amount):	-
PC ratio (academic staff):	1-1
PC Ratio (admin staff):	1-1
PC Ratio (student-technical):	1-7
PC Ratio (student-non technical):	1-7
Acquisition (hardware):	Centralized
Acquisition (software):	Centralized
Upgrade (hardware):	Centralized
Upgrade (software):	Centralized
Disposal:	After 5 years

IT Strategic Plan

Kolej Universiti O strategic plans for next five years are to implement e-university, e-learning and e-community and it is hoped that with this effort Kolej Universiti O will be more prepared and advanced in developing the university towards online facilities.

Kolej Universiti P

The profile of Kolej Universiti P is presented in Table 19a.

Table 19a: University Profile

Category:	University College
Year Established:	Confidential
Location:	Confidential
Number of branch:	Confidential
Number of faculty:	5
Number of department:	11
Number of centers/institute:	4
Number of student college:	0
Number of employee (academic):	296
Number of employee (administrative):	612
Number of student:	4773

Computer Support

Kolej Universiti P Computer Center has only 33 IT staff, including the director. Hence, computer center does not allocate IT staff to other responsibility centers. Despite its limited IT staff, the director felt that it has provided adequate IT training to its IT and non-IT staff, which is on a continuous basis. Trainings for non-IT staff are conducted in-house.

Table 19b: Computer Support Profile

Number of system analyst:	15
Number of programmer:	13
Number of technician/operator:	5
Number of lab assistant:	4
Other:	-
IT staff assign to responsibility center:	No
Staff assigned:	Not Applicable
Adequacy of IT staff:	No
Adequacy of IT training (IT):	Yes
Knowledge/skill required (if NO):	Not Applicable
Adequacy of IT training (non-IT):	Yes
Source of IT training (non-IT):	Internal

IT Infostructure

There are three major integrated systems currently implemented in Kolej Universiti P, which are Student Affairs, Personnel, and Finance systems. Student Affairs System is a Web-based application system. In terms of system development and maintenance, Kolej Universiti P uses a mix of internal and external expertise. For example, Personnel system is developed and maintained internally, whilst Finance and Student Affairs systems are developed externally but maintained internally by computer center. Table 19c presents a summary of application systems in Kolej Universiti P.

Table 19c: Application system

System	Integration	Development	Maintenance
Personnel	Fully	In house	Internal
Finance	Fully	External	Internal
Student Affairs	Fully	External	Internal
Teaching	None	None	None
Research & Development	None	None	None
Registration	Fully	External	Internal
Exam Scheduling	Fully	External	Internal
Library	-	External	External

In order to connect the hardware and the application systems, Windows, UNIX and Linux are used as the platform. With the total number of 4800 data points, it is sufficient to serve its campus Internet community. Table 17d presents a summary of operating and network systems in Kolej Universiti P.

Table 19d: Operating system and network

Operating system:	Widows, UNIX and Linux
Number of data point:	4800
Network service:	Leased line
Cabling system:	Structured cabling system, singlemode fiber optic, multimode fiber optic and unshielded twisted pair
Internet access (academic staff):	All
Internet access (admin staff):	All
Internet access (student):	All

IT Policy

Kolej Universiti P allocated about 5% of its annual budget for IT development. Five percent of the amount will be further allocated to other responsibility centers for their IT development. Kolej Universiti P adopted a policy that the acquisition, upgrade and disposal of hardware should be made through computer center. This policy will ensure that the hardware purchased is in accordance with the required standard and also to avoid overlapping acquisition. However, faculties are allowed to use their own IT budget to buy and/or upgrade software. Computer center will only provide basic software for campus usage.

Table 19e: IT Policy

Budget overall (%/amount):	5%
Budget responsibility center (%/amount):	5%
PC ratio (academic staff):	1-1
PC Ratio (admin staff):	1-2
PC Ratio (student-technical):	1-3
PC Ratio (student-non technical):	-
Acquisition (hardware):	Centralized
Acquisition (software):	Decentralized
Upgrade (hardware):	Centralized
Upgrade (software):	Decentralized
Disposal:	Centralized

IT Strategic Plan

Kolej Universiti P IT strategic plans for the next five years cannot be disclosed due to university policy.

Kolej Universiti Q

The profile of Kolej Universiti Q is presented in Table 20a.

Table 20a: University Profile

Category:	University College
Year Established:	Confidential
Location:	Confidential
Number of branch:	Confidential
Number of faculty:	3
Number of department:	-
Number of centers/institute:	-
Number of student college:	1
Number of employee (academic):	264
Number of employee (administrative):	460
Number of student:	5000

Computer Support

Kolej Universiti Q Computer Center has a total of 29 technical staff and 4 administrative staff. Thus the director of the center felt that it cannot provide as efficient and effective services as it wants to the campus community. The current ratio of technical staff to other staff is about 1 to 24. Furthermore, the staffs in particular programmers are burdened with too many responsibilities. Due to staff shortage, the computer center has decided not to assign technical staff to other responsibility centers. Hence, any problem faced by responsibility centers should be referred to the center. In addition to providing IT-related services, computer center also conducts basic IT training to non-IT staff.

Table 20b: Computer Support Profile

Number of system analyst:	6
Number of programmer:	15
Number of technician/operator:	7
Number of lab assistant:	1
Other: Admin	3
IT staff assign to responsibility center:	No
Staff assigned:	Not Applicable
Adequacy of IT staff:	No
Adequacy of IT training (IT):	Yes
Knowledge/skill required (if NO):	Not Applicable
Adequacy of IT training (non-IT):	Yes
Source of IT training (non-IT):	Mixed of internal and external

IT Infostructure

Kolej Universiti Q has developed and maintained several application systems to serve the needs of its campus community, mostly using internal expertise. However, most of these "in-house" applications such as "Sistem Maklumat Staf", "Sistem Pengurusan dan Penyelidikan", Sistem Maklumat Pelajar" and "Sistem Pendaftaran Pelajar" are isolated systems. Other systems like Finance and Library, were outsourced and then customized to meet the users need. This (e.g. different platforms) has created unnecessary integration problems to the department. The director of computer center, however, noted that it has put systems integration as one of its main agenda in the next 3 years.

Table 20c: Application system

System	Integration	Development	Maintenance
Personnel	Not integrated	In house	In house
Finance	Not integrated	External	External
Student Affairs	Not integrated	In house	In house
Teaching	Not integrated	External	External
Research & Development	Not integrated	In house	In house
Registration	Not integrated	In house	In house
Exam Scheduling	None	None	None
Library	Not integrated	External	External

Kolej Unievrsiti Q uses different types of operating systems such as Windows, UNIX and Linux. For network services, it uses a 16MB leased line, which will be upgraded to Wireless technology in the future. Unshielded twisted pair is used to connect PC from data point, whereas the multimode fiber optic is used if the distance is not more than 1000m and the singlemode fiber optic is used for distance less than 1000m. With a large number of data points, which is between 500 to 800 pieces, the staffs and students can have easy access to the Internet, including students' colleges.

Table 20d: Operating system and network

Operating system:	Windows, Unix, Linux
Number of data point:	500-800
Network service:	Leased line, Wireless
Cabling system:	Structured, Singlemode Fibre Optic, Multimode Fibre Optic, UTP
Internet access (academic staff):	All
Internet access (admin staff):	All
Internet access (student):	All

IT Policy

Kolej Universiti Q allocates about 25% of its total annual budget for IT infrastructure. However, this amount will be revised (normally reduced) after mid-year evaluation. The IT budget is allocated solely to the computer center with no allocation to other responsibility centers. Hence, all acquisition of hardware and software must be made through the centre. Normally, the acquisition process will be carried out twice a year. Hardware will be upgraded until it could not be upgraded anymore which will then be replaced. The disposal of hardware follows the JPA procedure. The university policy regarding the PC ratio is 1 to 1 for academic and administrative staff and 1 to 4 for students.

Table 20e: IT Policy

Budget overall (%/amount):	25%
Budget responsibility center (%/amount):	none
PC ratio (academic staff):	1:1
PC Ratio (admin staff):	1:1
PC Ratio (student-technical):	1:4
PC Ratio (student-non technical):	1:4
Acquisition (hardware):	Centralized (twice a year)
Acquisition (software):	Centralized (twice a year)
Upgrade (hardware):	Depends on PTJ
Upgrade (software):	Centralized
Disposal:	JPA procedure (Between 3 to 5 years)

IT Strategic Plan

For the next five years, Kolej Universiti Q plans to:

1. Strengthen the knowledge management system
2. Integrate all application systems
3. Develop a digital library
4. Implement Wireless system to the whole campus

6.0 SUMMARY, RECOMMENDATIONS AND CONCLUSIONS

In summary, a total of eleven universities and six university colleges participated in this study. Nearly half of the IPTAs are matured institution with more than 20 years experience, whilst twenty nine percent of the IPTAs were established for a period of 5 years or less. The number of academic staff ranges from 147 to 5626, whilst the number of students ranges from 1907 to 24697.

In terms of computer support, the participating IPTAs have different levels of capacity. Table 21 shows that eighty-eight percent (fifteen) of the respondents (i.e. director of IT center) felt that they do not have enough IT staff to provide efficient and effective IT services to the campus community. Almost half (eight) of the respondents also felt that their IT staff do not receive adequate IT training.

Table 21: Adequacy of IT Staff and IT Training

Institutions	IT Staff	IT Training
Universiti A	Yes	Yes
Universiti BPM	No	No
UniversitiM C	No	Yes
UniversitiSM D	No	No
UniversitiTM E	Yes	No
UniversitiMS F	No	No
UniversitiIA G	No	Yes
UniversitiKM H	No	Yes
UniversitiiTM I	No	Yes
UniversitiPSI J	No	Yes
UniversitiNIMAS K	No	No
KUKTEMKolej Universiti L	No	Yes
Kolej UniversitiKUITTHO M	No	No
Kolej UniversitiKUKUM N	No	No
Kolej UniversitiKUIM O	No	No
KKolej UniversitiUTKM P	No	Yes
Kolej UniversitiKUSTEM Q	No	Yes

Table 22 shows a summary of IT training needed by the IPTAs. Among the knowledge and skills required by the IPTAs are advance programming languages, networking, open source system, mobile application, office automation, e-learning, knowledge management and project management.

Table 22: A Summary of Important IT Training

Institutions	Training
UPMUniversiti B	√ Project management
USMUniversiti D	√ Mobile application
Universiti ETM	√ Latest technology
Universiti MSF	√ Networking √ Advance programming
UNIMASUniversiti K	√ JAVA programming √ Open source √ Knowledge management
Kolej UniversitiKUITTHOM	√ System analysis and design √ Strategic planning
Kolej Universiti NKUKUM	√ Database administration √ Networking √ Advance programming
Kolej Universiti OKUIM	√ Networking √ Multimedia √ E-learning √ Office automation

Note: IPTAs with adequate IT training are not listed

Table 23 shows the type of application systems adopted by the IPTAs. The table shows the status of integration, development, and maintenance of each application system adopted.

Table 23: A Summary of Application Systems

Institution	Personnel			Finance			Student Affairs			Teaching			R & D			Registration			Exam Sched.		
	I	D	M	I	D	M	I	D	M	I	D	M	I	D	M	I	D	M	I	D	M
Universiti AUM	F	I	I	F	I	I	F	I	I	F	E	J	F	I	I	F	I	I	F	I	I
Universiti BPM	P	J	J	P	E	E	P	I	I	N	I	I	P	E	E	P	I	I	P	I	I
Universiti CM	F	J	J	F	I	J	F	I	I	F	J	J	F	I	I	F	I	I	F	I	I
Universiti DSM	P	E	I	P	E	I	P	E	I	P	E	I	P	E	I	P	E	I	P	E	I
Universiti ETM	N	I	I	N	I	I	P	I	I	N	I	I	E	E	E	P	I	I	P	I	I
Universiti FMS	N	E	E	P	E	E	P	E	E	N	I	I	X	X	X	P	E	E	P	E	E
Universiti GIA	P	J	J	F	E	J	F	I	I	P	E	E	X	X	X	F	I	I	F	I	I
Universiti HKM	F	I	I	F	I	I	F	I	I	F	I	I	F	I	I	F	I	I	F	I	I
Universiti IUiTM	P	J	I	P	J	J	P	J	I	P	E	I	P	E	J	X	X	X	X	X	X
Universiti JPSI	F	E	I	F	E	I	F	E	I	F	E	I	F	E	I	F	E	I	F	E	I
Universiti KNIMAS	P	J	J	P	J	J	P	I	I	N	J	I	N	I	I	N	I	I	N	E	I
KU LKUKTEM	F	I	I	F	I	I	F	I	I	F	I	I	F	I	I	F	I	I	F	I	I
KU	F	I	I	F	E	E	F	I	I	-	E	E	X	X	X	F	I	I	X	X	X

MKUITTHO																					
KU NUKUM	F	E	J	F	E	J	F	E	J	F	E	J	F	E	J	F	E	J	F	E	J
KU OUIM	F	J	J	F	J	J	F	J	J	X	X	X	X	X	X	F	I	I	F	I	I
KU PUTKM	F	I	I	F	E	I	F	E	I	X	X	X	X	X	X	F	E	I	F	E	I
KU QUSTEM	N	I	I	N	E	E	N	I	I	N	E	E	N	I	I	N	I	I	X	X	X

Note: I = Integration, D = Development, M = Maintenance; F = Fully Integrated, P = Partly Integrated, N = Not Integrated; I = Internal, E = External, J =Joint, and X = No

From Table 23, eleven IPTAs in bold font are found to have adopted less sophisticated IT (i.e. the application systems are not fully integrated) and thus require further information systems development. Among IPTAs that have yet to achieve a fully integrated system are Universiti ~~Malaysia Sabah~~B, Universiti ~~Teknologi Malaysia~~D, Universiti ~~Sains Malaysia~~E, Universiti ~~Putra Malaysia~~F, and Kolej Universiti ~~Islam Malaysia~~O. Other IPTAs like Universiti ~~Kebangsaan Malaysia~~A and Universiti ~~Utara Malaysia~~H that have successfully integrate all application systems need to enhance their network infrastructure and develop a more comprehensive e-learning system.

Finally, Table 24 shows a summary of strategic IT plan of each IPTAs. However, five IPTAs cannot disclose their IT plans due to the university policy. Among the important IT plans set by these IPTAs for the next five years are to provide a wireless campus, a fully integrated systems with Web support, and a comprehensive e-university which covers e-learning, e-administration, e-community etc.

Table 24: A Summary of IT Strategic Plan

Institutions	IT Strategic Plans
Universiti A~~UUM~~	√ Upgrade network infrastructure √ Enhance wireless coverage √ Setup disaster recovery plan
Universiti~~PM~~ B	√ Wireless campus √ Develop a portal system that integrates students, staffs and community √ Develop security system (CCTV) around campus √ Integrate all application systems in university √ Develop digital library and document management systems
Universiti~~MS~~ F	√ Develop a fully integrated system √ Develop a Web based system √ Open sources √ Outsource up to 50 percent of PC maintenance √ Hotspot for every college

UniversitiIA G	√ E-university, E-administration, E-learning, E-community and E-Hospital and Telemedicine √ Develop super highway infrastructure and application systems √ IT and Multimedia in classes √ Smart & Intelligent campus (Physical Management System, Utilities Management System and Security) √ Digital Resource Center √ Smart (Smart Wallet, Identification and Security)
UniversitiKM H	√ Fully develop the content of E-learning √ High bandwidth in campus √ Intranet anyway and anytime
UniversitiiTM I	√ PC ratio for students will be reduced to 1 to 5. √ Set up Disaster Recovery Center √ Integrate all application systems by setting up the Service Agent √ Upgrade the administrative system with the latest technology √ Upgrade the network speed between main campus and its branches. √ Set up the Centralized Help Desk √ Develop Centralized Document System
UniversitiPSI J	√ Development and enhancement of Integrated Management System √ Upgrading network infrastructure and Internet connections √ Centralized backup and Data Continuity Center √ ICT Training and consultation √ Procurement of PC, notebooks and servers
UniversitiNIMAS K	√ Fully Integrated system √ Knowledge management
KUKTEMKolej Universiti L	√ To upgrade the network infrastructure so that it can become more reliable. √ To update the IT devices such as PC and router for their permanent campus in the year 2008.
Kolej UniversitiKUKUM N	√ To strengthen the campus networking √ To set up new technologies such as smart card and laser technology √ To further strengthen its application systems

Kolej Universiti~~KUIM~~ O	√	e-university
	√	e-learning
	√	e-community

Kolej Universiti~~KUSTEM~~ Q	√	Strengthen the knowledge management system
	√	Integrate all application systems
	√	Develop a digital library
	√	Implement Wireless system to the whole campus

Note: IPTAs that do not disclose their plan are not listed

As a conclusion, this study has been successful in shedding the light of the sophistication of IT adopted by IPTAs in Malaysia. Despite the shortage of experience IT staff, all IPTAs have taken necessary steps to enhance their IT services to the campus community. Among the IT initiatives already in place include university-wide and Web-based information systems. Some of the IPTAs are quite advance in terms of its application systems compared to others. However, those with less sophisticated systems, especially newly established IPTAs and in particular university colleges have already planned to enhance their IT infostructure in their IT strategic plans. These IPTAs are looking for a joint-venture with outside consultants to accomplish their mission to be a world-class university with a world class IT facilities. Smart partnerships with the software providers seem to be the best solution for these IPTAs. Therefore, a lot of opportunities exist for the consultants to joint-venture with these IPTAs.

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